

Ref #100

For information of 631
Mr. Keen Coeur d'Alene

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE
FOREST INSECT INVESTIGATIONS

EIGHTH ANNUAL SURVEY OF THE MOUNTAIN
PINE BEETLE INFESTATION IN THE
COEUR D'ALENE NATIONAL FOREST

By
T. T. Terrell
Scientific Aide

Forest Insect Laboratory
Coeur d'Alene, Idaho
March 31, 1937

EIGHTH ANNUAL SURVEY OF THE MOUNTAIN
PINE BEETLE INFESTATION IN THE
COEUR D'ALENE NATIONAL FOREST

Mountain pine beetle infestations in white pine stands destroy thousands of trees annually. Although the losses that the national forests of Region One have suffered are hard to estimate, they are an important factor in the successful management of white pine. Outbreaks of the mountain pine beetle fluctuate in intensity from year to year and are eventually reduced to a normal status by environmental factors. During the course of an epidemic, which occurs in indefinite cycles, the loss may vary from a large percentage of the stand, or in other instances the damage may be comparatively light.

During the past eight years valuable data has been secured from the annual survey of the mountain pine beetle infestation in the white pine stands of the Coeur d'Alene National Forest. Varying with the intensity of the infestation within the different units, control measures have been applied during the years 1930-1935 inclusive, and the results obtained from the annual survey on the infestation have been followed. Data relative to the amount of control instituted during these years were shown in last year's report. No further control measures have been applied with the exception of an experimental medication project conducted during September 1936, when 156 trees were treated with poison in Deception and Cascade Creeks.

As a result of the data secured from the annual surveys of this project a statement was made in the report of the 1935 survey that the infestation would continue in its existing severity for not more than one more year and then decline without further control measures. The data secured from the 1936 survey show this statement to have been a conservative prophecy. The decline occurred during the first year with a 71 percent decrease in the infestation throughout the forest.

The following table presents the conditions existing on the forest for the past nine years.

Table I
COEUR D'ALENE FOREST SUMMARY OF THE
ANNUAL INSECT INFESTATION SURVEY 1936

	1928	1929	1930	1931	1932	1933	1934	1935	1936
Acres surveyed*	9,000	99,540	107,830	127,550	127,430	124,320	115,410	113,910	113,910
New attacks per acre	.275	.300	.087	.098	.118	.157	.207	.184	.053
Percent of increase	No data	No data	-71	+13	+20	+33	+32	-11	-71
Percent windfalls	No data	No data	No data	56	50	51	47	16	21
Infested trees	2,500	29,881	9,371	12,496	14,457	19,520	24,466	20,952	6,058
Acres recommended for control	9,000	99,540	61,770	52,120	32,940	3,200	23,880	None	None
Trees estimated for treatment	2,500	25,904	6,801	8,717	6,757	1,281	6,725	None	None
Year in which control was conducted	1929	1930	1931	1932	1933	Fall	1935		
Acres treated	5,620	73,210	39,180	40,666	27,204	3,622	9,213		
Trees treated	1,074	22,926	7,106	7,906	6,434	877	2,874	283 Med.	156 Med.

c.l. - Cull logs (2 c.l.--1 tree for comparison)

Med. - Treated by experimental medication

* The surveyed acreage shows a variation, because in some instances new areas were found to be infested and were added; other areas were logged off or burned over and therefore dropped.

During the past four years the infestations on the various units of the forest have presented many complex problems. Each unit usually presents a variation in some form from the infestation in other units, although they may at times lie adjacent.

In general there are only three factors that cause these variations, which can be listed as: number of infested trees per acre, amount of nonresistant host material on the unit, and intensity of attack. When these three factors are compared for two seasons, any variation in the infestation can be seen as a change in one of these factors. There are seven different types of infestation which may be classified by determining the annual change that takes place. The first four are of primary importance.

Type	Trees per acre	Nonresistant host material	Heavy attacks
I	Increase	Increase	Decrease
II	Decrease	Decrease	Increase
III	Decrease	Increase or decrease	Decrease
IV	Increase	Decrease	Increase

The first type comprises infestations that have increased in the number of trees attacked and in abundance of nonresistant host material, such as windfalls, but at the same time have shown a decrease in heavy attacks. Such a condition may mean that the insect population has made fewer attacks in a greater number of trees.

The second type of infestation, which is the reverse of the first type, shows a decrease in number of infested trees per acre and in nonresistant host material but an increase in heavy attacks. In this instance a greater number of attacks has been made on a lesser number of trees. It can be easily understood that these two types of infestation may have the same insect population, but in infested trees per acre there will be a wide variance.

The third type of infestation shows a decrease in infested trees per acre, an increase or decrease in nonresistant host material, and a decrease in heavy attacks. This type indicates a declining infestation.

The fourth type is an infestation showing increases in trees per acre and in heavy attacks with a decrease in nonresistant host material. It would be unusual for an infestation of this type to have an increase in nonresistant host material, for such an increase would tend to thin the attacks out until it would fall under type one.

Three other possible combinations of conditions that may sometime occur are the following:

Type	Trees per acre	Nonresistant host material	Heavy attacks
V	Increase	Increase	Increase
VI	Increase	Decrease	Decrease
VII	Decrease	Increase	Increase

The occurrence of Types VI and VII would be very unusual, because an infestation showing an increase in trees per acre and a decrease in both nonresistant host material and in heavy attacks, as in Type VI, would not be a reasonable condition, for if there were an increase in trees per acre and at the same time the stand became more resistant because of the disappearance of nonresistant material, the attacks per tree would necessarily be heavier. If such a condition should occur, it would indicate a general weakening of the stand through some unapparent cause such as the infection of root fungus. If such a condition is found to exist, then the infestation would be classed as Type I. It would be highly improbable that a decreasing infestation with an increased amount of nonresistant host material (Type VII) would show an increase in heavy attacks.

To sum up the above types: Types I, II, VI, and VII may have the same insect population per acre. A unit showing Type I infestation may change into Type II, VI, or VII the following year with no change in insect population, although the infested trees per acre may be entirely different.

Type III indicates a lowering insect population, and very favorable conditions.

Types IV & V can only indicate a rising infestation.

Type VI indicates some unusual occurrence taking place in the stand.

It is recognized that this classification of infestation types is as yet incomplete. The abundance of parasites and predators must be considered as a very important factor.

In the following pages each unit will be tabulated separately to show the variation from year to year. The degree of severity of the attacks has also been tabulated and divided into heavy, medium, or light. During the 1933 and 1934 surveys the severity of attack was based only on a strip runner's reaction to each infested tree as he marked it down. However, during the 1935 and 1936 surveys an attempt was made to correlate the severity of attack more closely, and each tree was tabulated according to the number of attacks per square foot at the base of the tree. A tree with from 1 to 5 attacks per square foot was classed as light, one with 6 to 9, medium, and over 9, heavy. This classification was used because it closely approaches the classification of 1933 and 1934.

The type of infestation existing on the units for the last three years is also included, where data are available, to show the trend from one type to another.

LITTLE RIVER DISTRICT

Forks Unit: 1,100 acres - 28 infested trees - .4 percent of stand

Infested Trees per Acre and Change in Status						
Year	Standing	Windfalls	Total	Percent	Attack %	Type
1933:	.043	.056	.099	-36	43	43 14
1934:	.014	.324	.338	+241	13	54 33 I
1935:	.055	.222	.227	-18	0	40 60 III
1936:	.013	.013	.026	-91	0	50 50 III

Prior to the 1936 survey, counts of the green stand showed this area to average 24 green trees per acre. However, the recent logging has so reduced the stand that the 1936 survey strips show only 7 green trees per acre. This is no doubt a big factor in the reduction of the infestation in the unit. Quite a number of logs which were in the process of being taken out were seen to have been recently attacked.

Tom Lavin Unit: 3,000 acres - 183 infested trees - .9 percent of stand

Infested Trees per Acre and Change in Status						
Year	Standing	Windfalls	Total	Percent	Attack %	Type
1933:	.024	.071	.095	-6	58 33 9	
1934:	.058	.075	.133	+40	13 31 56 I	
1935:	.026	.032	.058	-56	11 22 67 III	
1936:	.050	.011	.061	+5	0 0 100 *	

* Believed to belong to Type III.

Intensive logging operations in the Tom Lavin unit reduced the green stand from 17 green trees per acre to approximately 7 in 1935. As the logging operations were largely conducted during the summer months, there is little doubt that a large part of the infestation was taken out in the form of attacked logs, in the same manner as that which occurred in the Forks unit this year. Hence, a reduction occurred in the Tom Lavin unit in 1935 that is somewhat comparable to the reduction in the Forks district this year. However, a slight increase occurred in this unit in 1936 which was the only increase recorded on the forest.

Although logging operations sometimes materially reduce the infestation during the season of the work, a light increase in the number of infested trees per acre usually occurs the first year following. This increase is no doubt due to the comparison of a low point, reached when large numbers of infested logs are removed, to an infestation of light attacks in numerous trees weakened temporarily by the opening up of the stand. It is doubtful if these light increases would be maintained for more than a year or two.

Iron Cr. Unit: 4,120 acres - 173 infested trees - 0.3 percent of stand

Infested Trees per Acre and Change in Status

Year	Standing	Windfalls	Total	Percent	Attack	Heavy	Medium	Light	Type
1933:	.052	.112	.164	+61	68	14	18	1	
1934:	.081	.257	.338	+106	30	40	30	1	
1935:	.323	.005	.328	-3	81	14	5	11	
1936:	.038	.004	.042	-87	11	56	33	III	

The infestation in Iron Creek, which last year consisted of groups of very heavily attacked trees, followed the course predicted for such units by showing a marked decrease.

Logging operations which are planned for the area during 1937 will probably cause a further reduction in the infestation.

Cathcart Creek Unit: 3,200 acres - 73 infested trees - 0.3 percent of stand

Infested Trees per Acre and Change in Status							Type
Year	Standing	Windfalls	Total	increase	Percent	Attacks %	
1933:	.058	0	.058	-75	75	72	I
1934:	.034	.075	.109	+85	85	0	II
1935:	.050	0	.050	-54	54	64	III
1936:	.017	.006	.023	-54	54	0	
						25	
						75	

The infestation is very nearly normal in this unit, as may be seen from the small number of infested trees per acre and the high percentage of light attacks. During past years when the attacks were all in standing trees, the majority of the attacks were classed as heavy, while during 1934 when 69 percent of the infested trees were in windfalls the attacks were very light.

Cascade Unit: 3,640 acres - 364 infested trees - 0.7 percent of stand

Infested Trees per Acre and Change in Status					
Year	Standing	Windfalls	Total	Percent increase	Attacks %
					Heavy:Medium:Light
1933:	.169	.183	.352	+283	76 : 12 : 12
1934:	.042	.125	.167	-52	18 : 43 : 39 : III
1935:	.169	.032	.201	+20	68 : 16 : 16 : II
1936:	.077	.023	.100	-50	5 : 27 : 68 : III

The infestation in Cascade is still relatively high, although a substantial decrease occurred in 1936. It was found that 41 percent of the infested standing trees were also infested with a root fungus that is quite prevalent in the drainage.

Picnic Unit: 1,680 acres - 113 infested trees - 1.4 percent of stand

Infested Trees per Acre and Change in Status					
Year	Standing	Windfalls	Total	Percent increase	Attacks %
					Heavy:Medium:Light
1933:	.111	0	.111	+22	75 : 25 : 0
1934:	.018	.268	.268	+158	6 : 44 : 50 : I
1935:	.089	0	.089	-69	100 : 0 : 0 : II
1936:	.067	0	.067	-25	0 : 17 : 83 : III

The Picnic Creek drainage has been logged off in recent years and has only from five to nine green trees per acre. The infestation is very nearly normal for such areas. Most of the attacks are confined to weakened trees that are infested with root fungus.

Honeysuckle Unit: 5,320 acres - 617 infested trees - 0.7 percent of stand

Infested Trees per Acre and Change in Status						Attacks %			Type
Year	Standing	Windfalls	Total	increase	Percent	Heavy	Medium	Light	
1933:	.055	.027	.082	-49	59	29	12	1	
1934:	.121	.100	.221	+169	17	36	47	2	I
1935:	.143	.032	.175	-21	45	34	21	2	II
1936:	.073	.043	.116	-34	3	8	89	1	III

Leiberg Unit: 4,440 acres - 62 infested trees - 0.2 percent of stand

Infested Trees per Acre and Change in Status						Attacks %			Type
Year	Standing	Windfalls	Total	increase	Percent	Heavy	Medium	Light	
1933:	.013	.007	.020	-80	33	33	33	0	
1934:	.039	.137	.176	+780	11	22	67	2	I
1935:	.094	.020	.114	-35	65	29	6	2	II
1936:	.007	.007	.014	-88	0	0	100	0	III

Leiberg was logged off a number of years ago, and there is not enough timber remaining to support a severe infestation. Only one standing and one infested windfall were found on 147 acres of sample strip during the 1936 survey. The standing tree was also infested with root fungus.

Laverne Unit: 2,560 acres - 197 infested trees - .7 percent of stand

Infested Trees per Acre and Change in Status						
Year	Standing	Windfalls	Total	Percent	Attack %	Type
1933	.046	0	.046	-63	20 : 80 : 0	
1934	.049	.061	.110	+139	11 : 33 : 56	I
1935	.125	.021	.146	+33	14 : 64 : 22	IV
1936	.044	.033	.077	-47	0 : 30 : 70	III

The last control measures in Laverne Creek were conducted in the spring of 1933. During the following two years increases occurred which were attributed to heavy, crowded stands in the creek bottoms. Natural controlling factors have now reduced this infestation to a more nearly natural condition.

Copper Creek Unit: 4,000 acres - 0 infested trees - 0 percent of stand

Infested Trees per Acre and Change in Status						
Year	Standing	Windfalls	Total	Percent	Attack %	Type
1933	.077	.026	.103	-2	62 : 25 : 13	
1934	.080	.019	.099	-4	50 : 50 : 0	III
1935	.124	.020	.144	+45	36 : 41 : 23	I
1936	0	0	0	-100	0 : 0 : 0	III

Although no infested trees were found on 163 acres of sample strips during 1936, there is no doubt that a very light infestation exists.

No control measures were ever instituted on this area, and the infestation decreased from a high point of .156 infested tree per acre reached in 1931 to .099 in 1934. Intermittent logging throughout this period no doubt plays an important part in the trend of this infestation.

The following table gives the summary of the units in the Little River District.

Table II
LITTLE RIVER DISTRICT

Unit	Acreage	New Attacks Per Acre						Infested trees 1936	
		1935		1936		% Increase			
		:Wind- fall	Total	:Wind- fall	Total				
Forks	1,100	.055	.222	.277	.013	.013	.026	-91 28	
Tom Lavin	3,000	.026	.032	.058	.050	.011	.061	+ 5 183	
Iron Cr.	4,120	.323	.005	.328	.038	.004	.042	-87 173	
Cathcart	3,200	.050	.000	.050	.017	.006	.023	-54 73	
Cascade	3,640	.169	.032	.201	.077	.023	.100	-50 364	
Picnic Cr.	1,680	.089	.000	.089	.067	.000	.067	-25 113	
Honeysuckle	5,320	.143	.032	.175	.073	.043	.116	-34 617	
Leiberg	4,440	.094	.020	.114	.007	.007	.014	-88 62	
Laverne	2,560	.125	.021	.146	.044	.033	.077	-47 197	
Copper Cr.	4,000	.124	.020	.144	.000	.000	.000	-100 0	
Total Little:									
River Unit	33,060	.132	.027	.159	.039	.015	.054	-66 1,810	

GRIZZLY MOUNTAIN DISTRICT

Taylor's Unit: 2,800 acres - 48 infested trees - 0.1 percent of stand

Year	Standing	Windfalls	Total	Percent increase	Attacks %			Type
					Heavy	Medium	Light	
1933	.043	.245	.288	+433	42	26	32	
1934	.151	.008	.159	-45	57	33	10	II
1935	.115	.020	.135	-15	33	42	25	III
1936	.017	.000	.017	-87	0	0	100	III

The steady decrease in this unit since 1933, with a corresponding decrease in heavy attacks, clearly shows the return toward a normal condition. No control measures have been instituted since 1932.

Forks-Cabin Unit: 5,440 acres - 158 infested trees - 0.1 percent of stand

Infested Trees per Acre and Change in Status							Type	
Year	Standing	Windfalls	Total	Percent increase	Heavy	Medium	Light	
1933:	.093	.185	.278	+112	30	41	29	
1934:	.184	.049	.233	-16	27	35	38	III
1935:	.194	.030	.224	-4	60	20	20	II
1936:	.029	0	.029	-37	0	11	59	III

The Forks-Cabin unit was one of the first units on which an attempt at biological control was made. During the last year of control in 1933, 713 trees were treated and about 200 infested trees were left untreated because they showed evidence of heavy parasitism.

Can Creek Unit: 1,760 acres - 32 infested trees - 0.1 percent of stand

Infested Trees per Acre and Change in Status							Type	
Year	Standing	Windfalls	Total	Percent increase	Heavy	Medium	Light	
1933:	.014	.041	.055	-37	50	25	25	
1934:	0	.118	.118	+114	25	50	25	I
1935:	.188	.012	.200	+69	57	43	0	II
1936:	.018	0	.018	-91	0	0	100	III

The very substantial decrease in the infestation on this unit brings it to a normal status. The former increases were attributed to the heavy infestation in the Forks-Cabin unit, which lies adjacent.

West Fork Unit: 3,960 acres - 147 infested trees - 0.2 percent of stand

Infested Trees per Acre and Change in Status							
Year	Standing	Windfalls	Total	Percent increase	Attacks %	Medium	Type
					Heavy		
1933:	.104	.072	.176	+71	45	32	23
1934:	.038	.061	.099	-44	0	75	25
1935:	.084	.014	.098	-1	58	21	21
1936:	.029	.008	.037	-62	0	11	89

Practically all of the infested trees found in this unit were of a nonresistant character because of broken tops and root fungus.

Clay Creek Unit: 2,320 acres - 137 infested trees - 0.2 percent of stand

Infested Trees per Acre and Change in Status							
Year	Standing	Windfalls	Total	Percent increase	Attacks %	Medium	Type
					Heavy		
1933:	.150	.096	.246	+47	36	18	46
1934:	.139	.101	.240	-2	25	42	33
1935:	.203	.068	.271	+13	69	9	22
1936:	.059	0	.059	-78	0	12	85

Over 50 percent of the infested trees found in this unit were either infected with root fungus or had broken tops. Broken-topped trees were quite plentiful throughout the Steamboat drainage this year.

and were especially noticeable in the Clay Creek unit.

Lower Cougar Unit: 3,600 acres - 119 infested trees - 0.2 percent of stand

Infested Trees per Acre and Change in Status							Type		
Year	Standing	Windfalls	Total	Percent increase	Attacks %	Heavy	Medium	Light	
1933:	.087	.102	.189	+26	::	18	23	59	II
1934:	.106	.019	.125	-34	::	38	47	15	II
1935:	.162	.014	.176	+41	::	54	46	0	IV
1936:	.033	0	.033	-81	::	0	40	60	III

Although control measures caused a decrease in the infestation in this unit during the year of 1930, further control measures in 1931, 1932, and 1933 failed to keep the infestation from increasing, but unquestionably held the loss to a minimum.

Upper Cougar Unit: 3,700 acres - 140 infested trees - 0.3 percent of stand

Infested Trees per Acre and Change in Status							Type		
Year	Standing	Windfalls	Total	Percent increase	Attacks %	Heavy	Medium	Light	
1933:	.010	.105	.115	-18	::	50	23	27	II
1934:	.026	.006	.032	-72	::	20	20	60	III
1935:	.087	.033	.120	+275	::	46	27	27	V
1936:	.019	.019	.038	-68	::	0	0	100	III

Root fungus is also prevalent in parts of the Upper Cougar unit. It is felt that the 275 percent increase recorded in 1935 is too high

considering the condition in the area the previous year. It is perhaps due to the finding of an unproportionate amount of infested trees on the sample strips.

Bumblebee Unit: 3,040 acres - 58 infested trees - 0.1 percent of stand

Infested Trees per Acre and Change in Status							Type	
Year	Standing	Windfalls	Total	Percent increase	Attacks	%		
					Heavy	Medium	Light	
1933	.114	.038	.152	+407	52	24	24	
1934	.117	0	.117	-23	65	35	0	II
1935	.146	0	.146	+25	69	23	8	IV
1936	.019	0	.019	-87	0	100	0	III

The Bumblebee unit was partially logged in 1934. A small increase occurred during the following year, which is a usual occurrence after logging operations.

The following table gives a summary of the units in the Grizzly Mountain District.

Table III
GRIZZLY MOUNTAIN DISTRICT

Unit	Acres	New Attacks per Acre						Infested trees 1936	
		1935			1936				
		: Wind=:	: Wind=:	%	: Wind=:	: Wind=:	%		
Taylors	2,800	.115	.020	.135	.017	0	.017	-87 48	
Fork Cabin	5,440	.194	.030	.224	.029	0	.029	-87 158	
Can Creek	1,760	.188	.012	.200	.018	0	.018	-91 52	
West Fork	3,960	.084	.014	.098	.029	.008	.037	-62 147	
Clay Creek	2,320	.203	.068	.271	.059	0	.059	-78 137	
Lower Cougar	3,600	.162	.014	.176	.033	0	.033	-81 119	
Upper Cougar	3,700	.087	.033	.120	.019	.019	.038	-68 140	
Bumblebee	3,040	.146	0	.146	.019	0	.019	-87 58	
Total	26,620	.145	.023	.168	.025	.004	.032	-81 839	

SHOSHONE DISTRICT

Sissons Unit: 4,700 acres - 465 infested trees - 0.4 percent of stand

Infested Trees Per Acre and Change in Status					
Year	Standing	Windfalls	Total	Percent increase	Attacks %
					Heavy Medium Light
1933	.212	.044	.256	+109	67 : 15 : 18
1934	.298	.012	.310	+21	22 : 45 : 33
1935	.296	.010	.306	-1	15 : 43 : 42
1936	.092	.007	.099	-68	11 : 29 : 60

Yellow Dog River Unit: 2,140 acres - 495 infested trees - 1.3 percent of stand

Infested Trees Per Acre and Change in Status					
Year	Standing	Windfalls	Total	Percent increase	Attacks %
					Heavy Medium Light
1933	.223	.162	.385	-34	65 : 16 : 19
1934	.427	.004	.431	+12	14 : 42 : 44
1935	.467	.033	.500	+16	21 : 10 : 69
1936	.165	.045	.213	-53	15 : 39 : 46

Yellow Dog Cr. Unit: 4,120 acres - 532 infested trees - 0.4 percent of stand

Infested Trees Per Acre and Change in Status					
Year	Standing	Windfalls	Total	Percent increase	Attacks %
					Heavy Medium Light
1933	.034	.041	.075	-44	85 : 6 : 6
1934	.100	.093	.193	+157	21 : 46 : 33
1935	.086	.053	.139	-28	48 : 22 : 30
1936	.089	.040	.129	-7	6 : 38 : 56

Downey Cr. Unit: 4,160 acres - 324 infested trees - 0.2 percent of stand

Infested Trees Per Acre and Change in Status							Attacks %	Type		
Year	Standing	Windfalls	Total	increase	Percent	Heavy	Medium	Light		
1933:	.141	.058	.199	+29	11	67	25	8	:	:
1934:	.265	.029	.294	+48	11	21	40	39	VI	:
1935:	.300	.083	.383	+30	11	33	42	25	V	:
1936:	.069	.009	.078	-80	11	17	17	66	III	:

The four units of Sissons, Yellow Dog River, Yellow Dog Creek, and Downey Creek have usually been the most heavily infested portions of the forest. Control measures were instituted annually from 1930 to 1935, although the 1935 control measures covered but a small portion of the area. In some instances decreases followed the application of control, but in most instances the infestation continued showing increases. It can not be said, however, that control measures did not prevent a very serious epidemic from developing in this heavily timbered area. The failure of control measures to prevent increases is mainly attributed to the weakness of the stand. It has been especially subject to root fungus, which in some instances has been found in 90 percent of the standing infested trees. Such trees have little resistance and provide excellent material in which the insects may make successful attacks. During the 1936 survey 27 percent of the standing infested trees were found to be infected with root fungus.

Of the four units, Sissons, Yellow Dog River, and Downey Creek

showed substantial reductions during the past year. The Yellow Dog River unit still has a comparatively high infestation-per-acre figure, but under the present conditions it is believed that a further reduction can be expected next year.

The Yellow Dog Creek unit, in infested trees per acre, is virtually the same as last year. However, the attacks are noticeably lighter and the infestation is mostly confined to a portion of the ridge between Yellow Dog Creek and Downey Creek in sections 21 and 22. It is felt that a further reduction can be expected in this unit in 1937.

Undoubtedly the four units listed above constitute the most susceptible area on the forest for insect attacks. A close watch should be kept on these stands, for it is possible that the first indication of future epidemics may occur in this area.

North Yellow Dog Unit: 840 acres - 29 infested trees - 0.1 percent of stand

Infested Trees Per Acre and Change in Status									
Year	Standing	Windfalls	Total	Percent increase	Heavy	Medium	Light	Attacks	Type
1933	.019	.356	.375	+ 4	56	41	3		
1934	.140	.094	.234	-36	27	53	20		III
1935	.683	.117	.800	+242	50	10	10		V
1936	.034	0	.034	-96	0	66	33		III

This was the most heavily infested unit on the forest in 1935.

The 1935 infestation occurred in very heavily attacked groups of trees. Many of the trees had as high as thirty or more attacks per square foot of bark surface at the base. Parasites were noticeably numerous in the heavily attacked trees, and the condition as a whole was considered as one marking the peak of an epidemic. It is quite evident that very little emergence took place, for the infestation has returned from a very high infestation to a nearly normal status in one year.

Lower Flat Cr. Unit: 4,120 acres - 95 infested trees - 0.1 percent of stand

Infested Trees per Acre and Change in Status											
Year	Standing	Windfalls	Total	increase	Percent	Attacks	%	Heavy	Medium	Light	Type
1933	.112	.112	.224	+1	1	78	19	3			
1934	.130	.044	.174	-22	22	36	39	25			III
1935	.007	.019	.026	-55	55	75	25	0			II
1936	.023	0	.023	-11	11	0	33	66			III

Bennett Cr. Unit: 580 acres - 21 infested trees - 0.2 percent of stand

Infested Trees per Acre and Change in Status											
Year	Standing	Windfalls	Total	increase	Percent	Attacks	%	Heavy	Medium	Light	Type
1933	0	.500	.500	+210	210	30	35	35			
1934	.196	.059	.255	-49	49	54	31	15			II
1935	.178	.036	.214	-16	16	33	33	33			III
1936	.037	0	.037	-53	53	0	0	100			III

Brett-Miner Unit: 1,550 acres - 15 infested trees - 0.1 percent of stand

Infested Trees per Acre and Change in Status							
Year	Standing	Windfalls	Total	Percent increase	Attacks %	Medium	Type
					Heavy		
1933	.025	.097	.125	+15	90	10	0
1934	.129	.032	.161	+29	45	40	15 IV
1935	.186	.014	.200	+24	71	0	29 IV
1936	.010	0	.010	-95	0	0	100 III

Rock City Unit: 1,600 acres - 21 infested trees - 0.1 percent of stand

Infested Trees per Acre and Change in Status							
Year	Standing	Windfalls	Total	Percent increase	Attacks %	Medium	Type
					Heavy		
1933	.102	.198	.300	+868	66	11	23
1934	.104	.017	.121	-60	64	29	7 II
1935	.027	.040	.067	-45	60	20	20 IV
1936	.013	0	.013	-81	0	0	100 III

The four units listed above are much the same in regard to the infestations. All show substantial reductions and the remaining attacks are nearly 100 percent light. The four units combined have but an estimated 152 infested trees.

Hawksite Unit: 8,780 acres - 210 infested trees - 0.2 percent of stand

Infested Trees per Acre and Change in Status							
Year	Standing	Windfalls	Total	Percent increase	Attacks %	Medium	Type
					Heavy		
1933	.046	.074	.120	+243	3	64	33
1934	.053	.040	.093	-22	16	57	27 III
1935	.084	.011	.095	+ 2	29	47	24 IV
1936	.021	.003	.024	-75	25	38	38 III

Cabin Cr. Unit: 7,000 acres - 336 infested trees - 0.4 percent of stand

Infested Trees per Acre and Change in Status									
Year	Standing	Windfalls	Total	Percent increase	Attacks	Heavy	Medium	Light	Type
1933	.060	.070	.130	+519	50	9	41	0	I
1934	.123	.110	.233	+79	44	41	15	0	V
1935	.186	.037	.223	-4	47	39	14	0	II
1936	.045	.003	.048	-778	27	7	66	0	III

Since the reduction in windfall material during the last two years, the infestation on those units, which was first absorbed by standing timber in 1935, decreased to a nearly normal state in 1936.

Control measures were instituted in the spring of 1935 against a heavy infestation in Cabin Creek, which was confined mostly to heavily attacked, standing trees. During the project 1,300 acres were covered, but 496 infested trees were left untreated because the brood was heavily parasitized. The effect of leaving these parasites was not expected to be felt until 1936. The 1935 infestation was practically unchanged, as the number of infested trees per acre was nearly the same as in 1934, and the status of attacked trees was similar to that of 1934. However, in 1936 the infestation decreased and the attacks were much lighter per tree.

Table IV
SHOSHONE DISTRICT

Unit	Acres	New Attacks per Acre						Infested trees 1936	
		1935			1936				
		: Wind -	: Stand -	: fall -	: Wind -	: Stand -	: fall -		
Sissions	4,700	.296	.010	.306	.092	.007	.099	-68 465	
Yellow Dog River	2,140	.467	.033	.500	.188	.045	.233	-53 498	
Yellow Dog Greek	4,120	.086	.053	.139	.089	.040	.129	-7 532	
Downey Cr.	4,160	.300	.083	.383	.069	.009	.078	-80 324	
N. Yellow Dog	840	.683	.117	.800	.034	0	.034	-96 29	
Lower Flat Greek	4,120	.007	.019	.026	.023	0	.023	-11 95	
Bennett Cr.	580	.178	.036	.214	.037	0	.037	-83 21	
Brett-Miner	1,550	.166	.014	.200	.010	0	.010	-95 15	
Rock City	1,600	.027	.040	.067	.013	0	.013	-81 21	
Hawksite	8,780	.084	.011	.095	.021	.003	.024	-75 210	
Cabin Cr.	7,000	.186	.037	.223	.045	.003	.048	-78 336	
Total	39,590	.179	.033	.212	.055	.009	.064	-70 2,546	

FORKS DISTRICT

Big Elk Unit: 4,960 acres - 307 infested trees - 0.5 percent of stand

Infested Trees per Acre and Change in Status					
Year	Standing	Windfalls	Total	Percent	Attack 4
					Heavy
1933:	.082	.089	.171	+111	No data
1934:	.045	.303	.348	+103	" "
1935:	.149	.035	.184	-47	69
1936:	.039	.023	.062	-66	21
					11
					68
					III

The 1935 brood which had emerged from an abundance of nonresistant material was forced into standing timber. The attacks per acre consequently decreased and a majority of attacks were heavy. The 1936 brood was also confined to standing timber and showed a further decrease as well as a decrease in heavy attacks.

Potter Creek Unit: 3,800 acres - 380 infested trees - 0.5 percent of stand

Infested Trees per Acre and Change in Status					
Year	Standing	Windfalls	Total	Percent	Attack 4
					Heavy
1933:	.116	.068	.184	+124	No data
1934:	.061	.667	.728	+296	No data
1935:	.267	.062	.329	-55	No data
1936:	.063	.017	.100	-70	30
					18
					52

The infestation in Potter Creek has in the past been confined largely to windfalls. However, when this material became unfit for

further infestation in 1935, the insects were forced into standing timber, which was attacked in relatively large groups. The groups were concentrated along the creek bottoms, and although there were quite large numbers of trees attacked in spots, the infestation was greatly reduced in trees per acre as compared to the year before. The trees were very heavily attacked and perhaps represented the entire insect population which had been scattered over the whole unit. During the late summer of 1935, 283 infested trees were treated during an experimental medication project. Although this was but a small portion of the infestation, it no doubt contributed to the general reduction.

Stewart Creek: 2,200 acres - 51 infested trees - .2 percent of stand

Infested Trees per Acre and Change in Status							
Year	Standing	Windfalls	Total	Percent increase	Attacks %	Type	
					Heavy	Medium	Light
1933:	.047	.016	.063	-43	:: No data		
1934:	.056	.296	.352	+459	:: No data		
1935:	.073	0	.073	-79	:: No data		
1936:	.015	.008	.023	-68	:: No data		

The infestation in the Stewart Creek drainage is comparable to the one in Potter Creek except on a much lighter pattern. The infestation increased materially following the occurrence of numerous windfalls in the area in 1934 and decreased when the nonresistant material was exhausted. The 1935 attacks were heavy and somewhat

grouped. The infestation is now practically normal.

Upper Flat Creek: 3,680 acres - 125 infested trees - .3 percent of stand

Infested Trees per Acre and Change in Status							
Year	Standing	Windfalls	Total	Percent increase	Attacks %	Type	
					Heavy	Medium	Light
1933	.025	.016	.041	0	80	0	20
1934	.058	.038	.096	+134	40	10	50
1935	.097	.037	.134	+ 39	60	40	0
1936	.025	.009	.034	- 75	0	25	75

FORKS DISTRICT

Unit	Acres	New Attacks per Acre			Infested trees				
		1935		1936					
		Wind	fall	Wind					
Big Elk	4,960	.149	.035	.184	.039	.023	.062	-66	307
Potter Cr.	3,800	.267	.062	.329	.083	.017	.100	-70	380
Stewart Cr.	2,200	.073	.0	.073	.015	.008	.023	-68	51
Upper Flat	3,680	.097	.037	.134	.025	.009	.034	-75	125
Total	14,640	.156	.036	.192	.043	.016	.059	-69	863

CONCLUSIONS

The decline of the infestation on the forest as a whole is considered to have been brought about by the building up of natural controlling factors to a point where they more than equaled the potentiality of the mountain pine beetle. Such a condition was materially aided by the application of control measures, which kept the infestation to a minimum of increase during the stages of its greatest potential. For this reason it is believed that the first three years of control were especially effective and that further control measures became progressively less effective each year as the biological controlling factors increased. This theory is advanced because control measures, as practiced on the Coeur d'Alene in the past, tended to destroy all insects within the trees treated. The large general decrease that occurred throughout the forest following the first year of intensive control in the spring of 1930 can be attributed directly to control. It is believed that the 1930 control project was instituted at a time when the greatest benefits could be secured. There have been decreases as well as increases in individual units following subsequent control measures, but no general decreases such as were secured following the 1930 project. The general plan of control measures practiced on the Coeur d'Alene Forest following the first major project in 1930, when as much of the forest as possible was treated, has been to treat only the spots of heavy infestation as they developed. Such a procedure is probably the best one that could have been followed, because it kept

the destruction of timber to a minimum while natural controlling factors were increasing.

During future infestations it would be well to consider many factors before instituting control measures. The type of infestation should be known, as well as the status of parasites and predators. Data of this character could be secured by the examination of relatively small areas in different sections of the forest. Such data should include information as to the character of the infestation during a two-year period, as a two-year comparison is essential in order to give an infestation its proper evaluation.

Respectfully submitted,

T. T. Terrell
Scientific Aide